presented earlier in this chapter (section 5.1). Final screening of the preliminary alternatives, and evaluation of the final alternative management approaches, is presented in Chapter 6.

5.3.1 Options Eliminated from Consideration Based on Scoping

The formal and informal scoping process for this EIS/EIR is described in Chapter 2. One of the key issues identified during the scoping period was a need to balance disposal among the three types of environments. In response to these and other comments, several potential approaches for long-term dredged material management were eliminated from consideration during the process of developing dredged material distribution scenarios. These included eliminating dredging, returning to pre-LTMS conditions, placing all dredged material in a single environment, and placing all material suitable for unconfined aquatic disposal in a single environment. These options are discussed below.

Eliminating Dredging is not considered a viable option for the San Francisco Bay Area. Failing to maintain and construct necessary navigational channels would eventually lead to shoaling in all of the shipping lanes and, in the worst case, effectively limit vessel traffic in the Estuary to recreational boats. This approach would not meet the overall goals of the LTMS, and would result in dire economic consequences for the region. It would also preclude realization of the environmental benefits that could be gained through reuse of dredged material.

A Return to Pre-LTMS Conditions is a second option that was eliminated from detailed consideration. In the late 1980s, a situation commonly referred to as "mudlock" created substantial economic hardship, uncertainty over regulatory policies and procedures, a lack of predictability for dredging project planning, and environmental concerns. The No-Action alternative considered in this EIS/EIR reflects important management changes that have come about *after* the establishment of the LTMS, such as improved interim sediment testing requirements, improved management of mounding at the Alcatraz disposal site, and designation of a deep ocean disposal site, which represents the first, major alternative to in-Bay disposal of most of the area's dredged material. A return to the situation in effect prior to the LTMS would be a significant step backward for all aspects of dredged material management in the Bay Area, would be inconsistent with the San Francisco Estuary Project's (SFEP) Comprehensive Conservation Management Program (CCMP), and would not achieve the objectives of the LTMS.

Placing All Dredged Material in a Single Environment was eliminated from consideration because this action also does not meet LTMS goals. Not all dredged material is suitable for disposal in all environments. For example, NUAD material may not be disposed at unconfined aquatic disposal sites in the Estuary or in the ocean under existing law. All classes of dredged material could theoretically be placed in hazardous waste landfills, but a large fraction of that material would be appropriate to reuse for beneficial purposes, and the volumes of material would quickly overwhelm disposal capacity for actual hazardous wastes that could then not be disposed of properly. In addition, reliance on any one disposal environment would leave the region once again vulnerable to "mudlock" if the chosen disposal environment were suddenly to become unavailable for any reason.

Placing All SUAD Material in a Single Environment was also eliminated from consideration for many of the reasons outlined above. The public scoping notice for this EIS/EIR included options that heavily emphasized disposal in individual environments. Further agency evaluation indicated a strong need to broaden the proposed material distributions. A mix of different disposal environments is also necessary to account for variation in disposal volumes over time; to address changing circumstances, project sizes, and economies of foreseeable dredging projects; and to avoid potentially significant impacts associated with disposal in one environment.

5.3.2 Development of Material Distribution Scenarios

A range of distribution scenarios was developed to reflect reasonable volume projections that could be managed in each type of environment. These scenarios were constructed in a step-wise fashion, as outlined below.

First, projections of the volume of material that will need to be dredged from existing navigation and berthing areas were made. These projections are outlined in section 3.1.2 and more fully described in Appendix E. For the purpose of developing long-term management approaches, the high range estimate of 5.93 mcy per year (a total of 296.5 mcy over a 50-year period) is used.

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Placing All Dredged Material in a Single Environment was eliminated from consideration because this action also does not meet LTMS goals. Not all dredged material is suitable for disposal in all environments. For example, NUAD material may not be disposed at unconfined aquatic disposal sites in the Estuary or in the ocean under existing law. All classes of dredged material could theoretically be placed in hazardous waste landfills, but a large fraction of that material would be appropriate to reuse for beneficial purposes, and the volumes of material would quickly overwhelm disposal capacity for actual hazardous wastes that could then not be disposed of properly. In addition, reliance on any one disposal environment would leave the region once again vulnerable to "mudlock" if the chosen disposal environment were suddenly to become unavailable for any reason.

Placing All SUAD Material in a Single Environment was also eliminated from consideration for many of the reasons outlined above. The public scoping notice for this EIS/EIR included options that heavily emphasized disposal in individual environments. Further agency evaluation indicated a strong need to broaden the proposed material distributions. A mix of different disposal environments is also necessary to account for variation in disposal volumes over time; to address changing circumstances, project sizes, and economies of foreseeable dredging projects; and to avoid potentially significant impacts associated with disposal in one environment.

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A range of distribution scenarios was developed to reflect reasonable volume projections that could be managed in each type of environment. These scenarios were constructed in a step-wise fashion, as outlined below.

First, projections of the volume of material that will need to be dredged from existing navigation and berthing areas were made. These projections are outlined in section 3.1.2 and more fully described in Appendix E. For the purpose of developing long-term management approaches, the high range estimate of 5.93 mcy per year (a total of 296.5 mcy over a 50-year period) is used.

Second, a range of feasible disposal options for upland/wetland reuse was developed. The capacity of potentially feasible UWR sites, and the timeframe within which these capacities could be developed, was evaluated (LTMS 1995d; BCDC 1995a). These upland/wetland site reuse capacities, together with the allowable disposal volume limits at existing aquatic disposal sites, were used to define the maximum levels of disposal that would be considered for each of the three disposal environments.

Third, historic data on the physical, chemical, and toxicity properties of dredged material was reviewed to estimate the volume of material that would be suitable for unconfined aquatic disposal (a framework for determining suitability is presented in Chapter 3). Based on this review, 80 to 90 percent of the material to be dredged over the next 50 years is expected to be suitable for unconfined aquatic disposal (SUAD-class material). Current regulations and policies would require the remaining 10 to 20 percent (NUAD-class material) to be confined in some manner. A portion of the NUAD material, depending on its characteristics, would be suitable for use in wetland restoration, landfill cover, construction fill, and other reuse options. (Confinement at any CAD sites that may be designated in the future is also possible.) A very small fraction of this material — expected to be less than 1 percent of the total dredged volume — would require handling and disposal as hazardous waste (see Chapter 3). For the purpose of this analysis, the high range estimate of 20 percent of all dredged material being NUAD (an average of 1.18 mcy per year, or 59 mcy over 50 years) is used. This volume of material would require appropriate management under any of the alternative management approaches, and would not be generally available for distribution among the placement environments. In contrast, the other 80 percent of all material (~4.7 mcy per year, or 237 mcy over 50 years) would be SUAD-class material that would theoretically be available for distribution among all of the placement environments.

The fourth step was to define an upper bound on the amount of SUAD material that would be considered for placement in any one environment. In response to public comments regarding a need for a balance among the three disposal environments, the LTMS agencies determined that no alternative long-term management approach would include more than 80 percent or less than 5 percent of the total volume of dredged SUAD material in any of the three environments.

The fifth step was to develop scenarios for material distribution using these upper (80 percent) and lower (5 percent) bounds. Three volume categories were defined:

- *High*: 65 to 80 percent of the material suitable for aquatic disposal; this corresponds to 3.1 to 3.8 mcy per year and 154.1 to 189.6 mcy over the 50-year planning period;
- *Medium*: 35 to 50 percent of the material suitable for aquatic disposal; this corresponds to 1.7 to 2.4 mcy per year and 83.0 to 118.5 mcy over the 50-year planning period; and
- *Low*: 5 to 20 percent of the material suitable for aquatic disposal; this corresponds to 0.2 to 0.9 mcy per year and 11.9 to 47.5 mcy over the 50-year planning period.

Discontinuous ranges were used to highlight the differences between use levels as much as possible.

Refer to Figure 2.9-1, which illustrates this evaluation process.

Based on the above considerations, six distribution scenarios were constructed that, overall, include the range of potential disposal volume categories (high, medium, and low) in each placement environment. The six scenarios are presented in Table 5.3-1. Three of the six scenarios involve placing a high percentage of dredged material in one environment with the remainder split between the other two environments. The other three scenarios achieve a more even balance of dredged material disposal by placing no more than a medium amount in any one environment.

5.3.3 Preliminary Alternatives Carried Forward for Consideration

Each of the alternative long-term approaches for management of Bay Area dredged material evaluated in this EIS/EIR consist of one of the distribution scenarios for SUAD-class material (presented in section 5.3) mcy per year.

Accordingly, the No-Action distribution scenario would involve the continued use of in-Bay sites up to a maximum level of 5.5 to 6.5 mcy per year, with low use of the SF-DODS, and upland or wetland reuse only as opportunities arise. All of the other distribution scenarios would involve less in-Bay disposal, and more upland or wetland reuse, than the No-Action scenario.

Four major characteristics distinguish No-Action from the other five alternatives:

- The vast majority of dredged material disposal would continue to occur within the already-stressed Estuary.
- This alternative relies primarily on the ocean disposal site for situations when in-Bay capacity is reached, but otherwise does not require specific levels of ocean disposal.
- It does not establish, provide for, or facilitate the beneficial reuse of dredged material in a coordinated fashion.
- It is associated with the lowest quantifiable economic costs when calculated on a project-by-project basis (but not necessarily on a regional basis).

Based on current 50-year projections, it appears that existing allowable disposal volume limits at in-Bay sites would be sufficient to manage all SUAD-class dredged material most of the time under No-Action. However, the No-Action Alternative represents an approach that leaves the region potentially vulnerable to situations where dredging needs periodically exceed in-Bay capacity. In this regard, the No-Action alternative does not meet the LTMS goals. Nevertheless, as required by NEPA and CEQA, it must be fully evaluated in this EIS/EIR to compare the relative benefits and consequences of the other action alternatives.

5.3.3.2 Preliminary Alternative B: Emphasize Aquatic Disposal (Minimal Upland/Wetland Reuse)

Preliminary Alternative B — Emphasize Aquatic Disposal — would include medium levels of disposal at both the existing in-Bay unconfined aquatic disposal sites and the SF-DODS. This represents a substantial reduction of long-term in-Bay disposal volumes (a long-term average of up to 2.4 mcy per year, as opposed to 4.8 mcy per year under No-Action). It also represents a substantial increase in ocean disposal (from less than 1 mcy per year under No-Action, to an average of as much as 2.4 mcy per year). Only low volumes of dredged material would go toward beneficial reuse in the UWR environment; however, substantially more material would be beneficially reused compared to No-Action. Conditions under Preliminary Alternative B are presented in Table 5.3-3.

Table 5.3-3. Preliminary Alternative B: Emphasize Aquatic Disposal (Medium In-Bay, Medium Ocean, Low UWR)

Conditions	*In-Bay Disposal*	*Ocean Disposal*	*Upland/Wetland Reuse*
Material Distributions			
Disposal Volume Limit	see note 1	6 mcy/yr[2]	NA
Annual Average Use	1.7 - 2.4 mcy/yr	1.7 - 2.4 mcy/yr	0.2 - 0.9 mcy/yr
Total 50-yr Volume (SUAD)	83.0 - 118.5 mcy	83.0 - 118.5 mcy	11.9 - 47.5 mcy
Total 50-yr Volume (NUAD)	NA	NA	59 mcy (avg 1.18 mcy/yr)
Policy-Level Mitigation Measures	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Protection • Site-Specific Review of CAD	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Conversion • Site-Specific Review of Rehandling and Confined Facilities, CAD, Wetland Restoration, and Levee Repair Use

Notes: 1. Administrative volume limits on in-Bay disposal are one option for implementing any dredged material placement scenario. This and other options are discussed more fully in Chapter 7.
2. The volume limit for the ocean site will be finalized by EPA after completion of this EIS/EIR and will be based on the preferred alternative and the need to provide for flexibility (see Chapter 7 discussion on agency actions following the final EIS/EIR).

5.3.3.3 Preliminary Alternative C: Emphasize Ocean Disposal

Preliminary Alternative C — Emphasize Ocean Disposal — would include high levels of disposal at the SF-DODS, and only low levels at existing in-Bay sites. This alternative represents the largest reduction of long-term in-Bay disposal volumes (an average of less than 1 mcy per year, as opposed to 4.8 mcy per year under No-Action) and therefore avoids or minimizes, to the greatest extent, the impacts and risks associated with disposal of large volumes of dredged material within the already-stressed Estuary. Similar to Preliminary Alternative B, only low volumes of dredged material would go toward beneficial reuse in the UWR environment; however, substantially more material would be beneficially reused compared to No-Action. Conditions under Preliminary Alternative C are presented in Table 5.3-4.

5.3.3.4 Preliminary Alternative D: Balance UWR and In-Bay Disposal (Minimal Ocean Disposal)

Preliminary Alternative D — Balance UWR and in-Bay Disposal — would include medium volumes of material going both to in-Bay disposal sites and to upland or wetland reuse. Only low volumes of material would be directed to the SF-DODS. Similar to Preliminary Alternative B, this alternative represents a substantial reduction of long-term in-Bay disposal volumes (an average of up to 2.4 mcy per year, as opposed to 4.8 mcy per year under No-Action). At the same time, it represents a substantial increase in the volume of dredged material that would go toward beneficial reuse in the UWR environment. Conditions under Preliminary Alternative D are presented in Table 5.3-5.

5.3.3.5 Preliminary Alternative E: Balance UWR and Ocean Disposal (Minimal In-Bay Disposal)

Preliminary Alternative E — Balance UWR and Ocean Disposal — would include medium levels of disposal at the SF-DODS, similar to Preliminary Alternative B. It would also include medium levels of material going toward beneficial reuse in the UWR environment, similar to Preliminary Alternative D. This alternative, like Preliminary Alternative C, also represents the largest reduction of long-term in-Bay disposal volumes (an average of less than 1 mcy per year, as opposed to 4.8 mcy per year under No-Action) and therefore avoids or minimizes, to the greatest extent, the impacts and risks associated with disposal of large volumes of dredged material within the already-stressed Estuary. Conditions under Preliminary Alternative E are presented in Table 5.3-6.

Table 5.3-4. Preliminary Alternative C: Emphasize Ocean Disposal (Low In-Bay, High Ocean, Low UWR)

Conditions	*In-Bay Disposal*	*Ocean Disposal*	*Upland/Wetland Reuse*
Material Distributions			
Disposal Volume Limit	see note 1	6 mcy/yr[2]	NA
Annual Average Use	0.2 - 0.9 mcy/yr	3.1 - 3.8 mcy	0.2 - 0.9 mcy/yr
Total 50-yr Volume (SUAD)	11.9 - 47.5 mcy	154.1 - 189.6 mcy	11.9 - 47.5 mcy
Total 50-yr Volume (NUAD)	NA	NA	59 mcy (avg 1.18 mcy/yr)
Policy-Level Mitigation Measures	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Protection • Site-Specific Review of CAD	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Conversion • Site-Specific Review of Rehandling and Confined Facilities, CAD, Wetland Restoration, and Levee Use

Notes: 1. Administrative volume limits on in-Bay disposal are one option for implementing any dredged material placement scenario. This and other options are discussed more fully in Chapter 7.
2. The volume limit for the ocean site will be finalized by EPA after completion of this EIS/EIR and will be based on the preferred alternative and the need to provide for flexibility (see Chapter 7 discussion on agency actions following the final EIS/EIR).

Table 5.3-5. Preliminary Alternative D: Balance UWR and In-Bay Disposal (Medium In-Bay, Low Ocean, Medium UWR)

Conditions	*In-Bay Disposal*	*Ocean Disposal*	*Upland/Wetland Reuse*
Material Distributions			
Disposal Volume Limit	see note 1	6 mcy/yr[2]	NA
Annual Average Use	1.7 - 2.4 mcy/yr	0.2 - 0.9 mcy/yr	1.7 - 2.4 mcy/yr
Total 50-yr Volume (SUAD)	83.0 - 118.5 mcy	11.9 - 47.5 mcy	83.0 - 118.5 mcy
Total 50-yr Volume (NUAD)	NA	NA	59 mcy (avg 1.18 mcy/yr)
Policy-Level Mitigation Measures	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Protection • Site-Specific Review of CAD	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Conversion • Site-Specific Review of Rehandling and Confined Facilities, CAD, Wetland Restoration, Levee Repair Use

Notes: 1. Administrative volume limits on in-Bay disposal are one option for implementing any dredged material placement scenario. This and other options are discussed more fully in Chapter 7.
2. The volume limit for the ocean site will be finalized by EPA after completion of this EIS/EIR and will be based on the preferred alternative and the need to provide for flexibility (see Chapter 7 discussion on agency actions following the final EIS/EIR).

5.3.3.6 Preliminary Alternative F: Emphasize Upland/Wetland Reuse

Preliminary Alternative F — Emphasize UWR —would include high levels of material going toward beneficial reuse in the UWR environment, the greatest amount of beneficial reuse of any of the alternatives. At the same time, like preliminary alternatives C and E, this alternative represents the largest reduction of long-term in-Bay disposal (an average of less than 1 mcy per year, as opposed to 4.8 mcy per year under No-Action) and therefore avoids or minimizes, to the greatest extent, the impacts and risks associated with disposal of large

Table 5.3-6. Preliminary Alternative E: Balance UWR and Ocean Disposal (Low In-Bay, Medium Ocean, Medium UWR)

Conditions	*In-Bay Disposal*	*Ocean Disposal*	*Upland/Wetland Reuse*
Material Distributions			
Disposal Volume Limit	see note 1	6 mcy/yr[2]	NA
Annual Average Use	0.2 - 0.9 mcy/yr	1.7 - 2.4 mcy	1.7 - 2.4 mcy/yr
Total 50-yr Volume (SUAD)	11.9 - 47.5 mcy	83.0 - 118.5 mcy	83.1 - 118.5 mcy
Total 50-yr Volume (NUAD)	NA	NA	59 mcy
Policy-Level Mitigation Measures	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Protection • Site-Specific Review of CAD	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Conversion • Site-Specific Review of Rehandling and Confined Facilities, CAD, Wetland Restoration, and Levee Use

Notes: 1. Administrative volume limits on in-Bay disposal are one option for implementing any dredged material placement scenario. This and other options are discussed more fully in Chapter 7.
2. The volume limit for the ocean site will be finalized by EPA after completion of this EIS/EIR and will be based on the preferred alternative and the need to provide for flexibility (see Chapter 7 discussion on agency actions following the final EIS/EIR).

volumes of dredged material within the already-stressed Estuary. Only low levels of disposal activity would occur at the SF-DODS, similar to Preliminary Alternative D. Conditions under Preliminary Alternative F are presented in Table 5.3-7.

Table 5.3-7. Preliminary Alternative F: Emphasize UWR (Low In-Bay, Low Ocean, High UWR)

Conditions	*In-Bay Disposal*	*Ocean Disposal*	*Upland/Wetland Reuse*
Material Distributions			
Disposal Volume Limit	see note 1	6 mcy/yr[2]	NA
Annual Average Use	0.2 - 0.9 mcy/yr	0.2 - 0.9 mcy	3.1 - 3.8 mcy/yr
Total 50-yr Volume (SUAD)	11.9 - 47.5 mcy	11.9 - 47.5 mcy	154.1 - 189.6 mcy
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Policy-Level Mitigation Measures	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Protection • Site-Specific Review of CAD	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs	• Material Suitability and Sediment Quality Testing • Site Management and Monitoring • Review of Dredging Needs • Habitat Conversion • Site-Specific Review of Rehandling and Confined Facilities, CAD, Wetland Restoration, and Levee Use

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2. The volume limit for the ocean site will be finalized by EPA after completion of this EIS/EIR and will be based on the preferred alternative and the need to provide for flexibility (see Chapter 7 discussion on agency actions following the final EIS/EIR).

CHAPTER 6.0 ENVIRONMENTAL CONSEQUENCES

This chapter evaluates the impacts and benefits of alternative approaches to dredged material disposal and reuse in the San Francisco Bay/Delta Estuary (the Estuary). First, in section 6.1, disposal and reuse in the three placement environments (ocean, in-Bay, and upland/wetland reuse [UWR]) are generically evaluated in terms of impacts and benefits associated with high, medium, and low overall volumes of dredged material. This evaluation is the last screening step for constructing the final alternatives carried forward for consideration. The final alternatives are each combinations of ocean, in-Bay, and upland/wetland reuse that differ by the relative volumes of dredged material that would go to each environment, and therefore by the degree to which beneficial reuse versus in-Bay or ocean disposal would be emphasized. The three final alternatives, along with the No-Action alternative, are compared and evaluated in section 6.2.

6.1 "GENERIC ANALYSIS" OF THE THREE PLACEMENT ENVIRONMENTS

As described in Chapter 3 (Dredging and Dredged Material Characteristics — An Overview) and Chapter 4 (Affected Environment), there are fundamental differences between the in-Bay, ocean, and upland environments in terms of the kinds of resources that may be affected by dredged material placement, the potential exposure pathways through which adverse effects may occur, and the opportunities to achieve environmental benefits by using dredged material as a resource rather than simply disposing of it as a waste. This section compares the three basic placement environments in light of these overall differences. The comparison is presented on an overall (not project-specific) basis to help identify the degree to which different levels of disposal activity in each type of placement environment should be included in the final alternatives carried forward for full evaluation. Therefore, this "generic analysis" represents the final step in the alternatives development process.

The important differences between the three basic placement environments, in terms of the potential environmental impacts and benefits of dredged material, are summarized in the sections that follow. In most cases, significant adverse environmental impacts would be avoided under any of the action alternatives, based on application of existing state and federal environmental laws and regulations, and the policy-level mitigation measures described in Chapter 5. Significant adverse environmental impacts are those that, for example, would result in the violation of an applicable federal or state environmental criterion, standard, or objective (e.g., for water or air quality); would cause the loss or substantial decrease in the local or regional population of a fish, wildlife, or plant species; or would jeopardize the continued existence of a state or federally listed special status or candidate fish, wildlife, or plant species, or substantially or adversely affect the critical habitat of such species. Even though potential adverse impacts would not generally be considered "significant" as defined above, various degrees of potential adverse impacts could still occur to different resources, depending on the alternative.

Throughout the evaluations that follow, the benefits and impacts of disposing of dredged material in the three placement environments are described on a relative basis. For example, the degree of actual adverse impacts to Estuary resources that is associated with current volumes of in-Bay dredged material disposal is impossible to accurately quantify with existing scientific information. The degree of impact from the other potential levels of disposal represented by the different alternatives also cannot be precisely quantified. This EIS/EIR therefore generally evaluates the alternatives in terms of the relative *risk* of adverse impacts occurring. Absolute impacts and benefits are discussed where appropriate. Benefits are described as "high benefit," "moderate benefit," "low benefit," or "negligible benefit." Risks and impacts are similarly described as "high risk/impact," "moderate risk/impact," "low risk/impact," or "negligible risk/impact." The ratings below are used throughout the following sections to describe the relative degree of potential environmental benefit and risk/impact of each preliminary alternative to each resource of concern. (Definitions for "negligible," "low," "moderate," and "high" benefit and risk/impact ratings differ with each resource, and are discussed in the section evaluating each resource.)

Relative Rankings	*Negligible*	*Low*	*Moderate*	*High*
Benefit Rankings	0	+1	+2	+3
Risk/Impact Rankings	0	-1	-2	-3

6.1.1 Water Quality Comparisons

Some degree of water quality impact will occur with disposal of dredged material in any of the placement environments, and at any disposal volume. Adverse water quality effects from ocean or in-Bay disposal could be associated with plumes from the initial disposal event, or in some cases from subsequent resuspension (from dispersive sites). In most cases such effects would be limited to the area of the plume following disposal, and would be temporary and localized. However, at higher disposal volumes there is a greater potential for some cumulative degradation of water quality to be associated with periods of high-frequency disposal (i.e., when multiple disposal events occur during a short time). No beneficial water quality effects are associated with unconfined ocean or in-Bay disposal of dredged material. Potential water quality impacts associated with upland/wetland reuse are more varied, and may be either adverse or beneficial depending on the type of reuse and the water body affected. The following paragraphs generally compare the potential water quality effects of disposal in the three placement environments. In all cases, the focus of this analysis is on disposal of the 80 percent of all dredged material assumed to be suitable for unconfined aquatic disposal ("SUAD" material).

The water quality impacts and benefits of high, medium, and low volumes of dredged material placed in each disposal environment are summarized in Table 6.1-1 and discussed in detail in the following sections.

6.1.1.1 Ocean Disposal

SF-DODS

There are no beneficial water quality effects associated with ocean disposal of dredged material. Therefore, a "negligible benefit" rating (0) appears in Table 6.1-1 for all disposal volumes.

The potential for adverse water quality effects to result from ocean disposal of SUAD material at SF-DODS is also limited, even at relatively high disposal frequencies. As described in Chapter 4, both computer modeling and real-time field monitoring of disposal at SF-DODS have shown that disposal plumes dissipate quickly to background levels, and that this occurs entirely within the boundaries of the disposal site. Since SF-DODS is a depositional site (in contrast to in-Bay sites discussed below) disposed material is not expected to resuspend into the water column, and therefore would not continue to affect water quality after its initial disposal.

The expected frequency of disposal events at SF-DODS was estimated in the EPA site designation Final EIS at about 3 barge loads (of 5,000 cubic yards [cy] each) per day (EPA 1993a). This was based on an assumed 6 million cubic yards (mcy) of dredged material per year being disposed at the site. Six mcy was evaluated in EPA (1993a) because it represented all of the SUAD material predicted at the time to be dredged from the San Francisco Bay Area each year (75 percent of the estimated 8 mcy total per year). At that disposal

Table 6.1-1. Potential Benefits and Impacts to Water Quality, by Placement Environment and Disposal Volume

Placement Environment	WATER QUALITY BENEFITS (a)			WATER QUALITY IMPACTS/ RISKS (b)		
	High Volume	Medium Volume	Low Volume	High Volume	Medium Volume	Low Volume
Ocean	0	0	0	-1	0	0
In-Bay	0	0	0	-2	-1	0
Upland/Wetland Reuse						
Habitat Restoration	+2	+2	+1	-1	0	0
Levee Maintenance	0	0	0	-1	-1	-1
Rehandling Facility	0	0	0	-1	0	0

Notes: a. Benefits:
+3 = High Benefit
+2 = Moderate Benefit
+1 = Low Benefit
0 = Negligible Benefit

b. Impacts/Risks:
-3 = High Risk/Impact
-2 = Moderate Risk/Impact
-1 = Low Risk/Impact
0 = Negligible Risk/Impact

volume the disposal frequency could be somewhat higher on occasion since, due to periods of extreme weather, the site may not be open for use at all times (there are no established seasonal site use restrictions at SF-DODS; however, the site designation final rule stipulates that barges may not be transported to the site when seas exceed 18 feet).

The overall disposal frequency at SF-DODS is expected to be less than estimated in EPA (1993a) for two reasons. First, LTMS has developed a revised, more realistic estimate of the total amount of material expected to be dredged over the next 50 years (see Chapter 3). The new estimate is approximately 6 mcy of dredged material per year (versus 8 mcy per year assumed in EPA [1993a]), and primarily reflects reduced dredging in the future as a result of military base closures. Based on this new, lower total, the quantity of SUAD material that is expected to be dredged is now estimated to be 4.8 mcy per year (80 percent of the 6 mcy total). Second, the LTMS agencies decided to consider a maximum of 80 percent of all SUAD material for disposal in any one placement environment, reflecting the need to have a diversity of disposal options available (see section 2.4). Therefore, this analysis assumes that an average of 3.8 mcy (80 percent of the 4.8 mcy of SUAD material) would actually be available for disposal at SF-DODS each year.

Assuming that the entire 3.8 mcy were directed to SF-DODS, this equates to an expected overall disposal frequency of 2 barge loads per day. If the frequency of site use occasionally tripled — to 6 disposal events on some days — water column plumes in some cases might not fully dissipate to background concentrations between disposal events, so that negligible-to-minor on-site cumulative water quality effects would be possible at times. These plumes would still dissipate within a matter of minutes to hours, within the disposal site boundaries, and would not result in federal water quality criteria being exceeded. Nevertheless, because some minor and temporary degradation of on-site water quality may occur during such higher-frequency use of the site, ocean disposal of high volumes of dredged material has been assigned a "low risk/impact" rating (-1) in Table 6.1-1.

At medium disposal volumes (2.4 mcy per year, or 50 percent of all SUAD material) and low disposal volumes (0.96 mcy, or 20 percent of all SUAD material), the frequency of disposal at SF-DODS would be even less. Plumes should fully dissipate between disposal events in almost all cases, and substantial periods of time may pass with no disposal activity at all. Disposal site use at these volumes is not expected to degrade on- or off-site water quality or to have any reasonable potential for cumulative impact. Therefore, a "negligible impact" rating (0) has been assigned in Table 6.1-1 to ocean disposal at medium or low volumes. It is important to note that even the very low degree of potential water quality impact identified for high volume use of SF-DODS would occur only within the boundaries of the disposal site; no adverse water quality effects are expected to occur outside the site boundaries, let alone in the Gulf of the Farallones National Marine Sanctuary or other sensitive areas.

San Francisco Bar Channel

The San Francisco Bar Channel ocean disposal site is not listed in Table 6.1-1 because its use and impacts do not vary with any of the scenarios being considered in this EIS/EIR. The dredging location and the disposal site are both located in a high energy environment outside the Golden Gate. The material disposed there is high quality (greater than 90 percent) sand dredged from the immediately adjacent channel, there are few fine particles, and the material is not expected to be a "carrier of contaminants" at concentrations of concern; thus the material meets testing exclusion criteria (40 CFR Part 227.13[b]). In addition, a limited volume of dredged material (approximately 650,000 cy/year) is disposed at the site on average. Finally, by federal rulemaking, the site may only be used by the COE for material dredged from the Bar Channel, and no change in these site use restrictions is anticipated. For these reasons, no adverse water quality effects are reasonably expected from continued use of the San Francisco Bar Channel disposal site.

6.1.1.2 In-Bay Disposal

As with ocean disposal, there are no water quality benefits associated with unconfined aquatic disposal at existing in-Bay sites. Water quality parameters identified in Chapter 4 as being of concern in terms of the potential for adverse impacts include dissolved oxygen, dissolved pollutant levels, ammonia and sulfides, and suspended solids/turbidity. Adverse changes to any of these parameters tend to be restricted to the immediate vicinity of the disposal plume; once plumes dissipate to background levels, immediate adverse water quality effects generally no longer exist. An exception is the South Bay, where water quality objectives are already exceeded (e.g., for copper), such that incremental additions would be problematic and the traditional concept of a mixing zone would not apply.

All of the existing in-Bay disposal sites — Suisun, Carquinez Strait, San Pablo Bay, and Alcatraz — are dispersive sites in shallow, estuarine waters (see Chapter 4). Compared to unconfined aquatic disposal at SF-DODS, there is greater potential for adverse water quality effects to be associated with disposal at any of the in-Bay sites. This is reflected in Table 6.1-1 as a higher environmental risk/impact rating for in-Bay versus ocean disposal. For example, some of the in-Bay sites are located in relatively restricted areas where initial disposal plumes can temporarily affect a substantial proportion of the embayment, or any fish migratory corridor within it (e.g., the Carquinez Strait site). In addition, subsequent resuspension of fine particles of dredged material from the sites can continue to affect water quality after the initial disposal event, incrementally increasing the overall suspended solids concentrations elsewhere in the embayment (e.g., the Alcatraz site). However, as with ocean disposal, the potential for in-Bay disposal to cause adverse water quality impacts is mainly associated with disposal frequency.

Compared to SF-DODS, there is a greater potential for high-frequency disposal to occur at in-Bay sites because of their proximity to dredging sites (faster turn-around time for barges from most projects), and because seasonal restrictions on dredging in some areas effectively forces multiple projects to dispose during limited time frames. Disposal frequencies have been quite high at times in the past. For example, between 1985 and 1987, an average of approximately 5 mcy per year was disposed at the Alcatraz site. On nearly two-thirds of the days during this period more than 10 disposal events occurred, and frequencies were occasionally as high as 41 disposal events per day (SFEP 1992b).

Under No-Action, almost all of the SUAD material would continue to be disposed at in-Bay sites, with the majority going to the Alcatraz site. Yearly and monthly disposal limitations have been placed on the in-Bay sites since amendments to the RWQCB's Regional Water Quality Control Plan were adopted in 1989. For Alcatraz, a yearly maximum of 4 mcy was established, with no more than 1 mcy per month allowed from October through April and no more than 300,000 cy per month allowed from May through September. Because of ongoing severe mounding problems at Alcatraz, additional limits were imposed on its use in Special Public Notice 93-3, published by the COE on February 1, 1993. PN 93-3 reduced the October through April monthly limits at Alcatraz to 400,000 cy from 1 mcy (the May through September limits of 300,000 cy remained unchanged, as did the overall yearly capacity of 4 mcy). In addition, no more than 150,000 cy during any month can be from clamshell dredging, and the COE reserves priority for the monthly capacity from February through May for its own maintenance dredging projects. Finally, up to 100,000 cy of dredged material proposed for Alcatraz (no more than 50,000 cy in any one month) can be redirected by the COE to the San Pablo Bay site if necessary. The Carquinez Strait site's annual capacity is set at 2 mcy in most years (3 mcy in above-normal water flow years), with no more than 1 mcy disposed in any month. The San Pablo Bay site's annual capacity is set at 500,000 cy, and the Suisun Bay Channel site's annual capacity is set at 200,000 cy (this site may only be used by the COE for sand from its maintenance dredging of the Suisun Channel).

At existing designated capacities, a total of 6.7 or 7.7 mcy per year could be disposed at the established in-Bay sites under No-Action. This is substantially greater than the LTMS revised long-term estimate of 4.8 mcy of SUAD material expected to be dredged over the next 50 years. However, even at the revised LTMS volume estimates, it is possible that the full monthly and annual capacity could be reached at any one of the existing in-Bay disposal sites in any given year. Therefore, the following evaluation of disposal frequency and potential water quality effects is based on worst-case disposal of the maximum monthly volumes allowed at each site. However, unlike disposal at SF-DODS where large 5,000-cy capacity ocean-going barges were assumed to be used, in-Bay disposal is expected to continue to occur using a mix of existing barge and hopper dredge capacities ranging from a few hundred cy up to 5,000 cy. For purposes of this general evaluation, a "typical" disposal load of 2,000 cy is assumed.

Alcatraz Disposal

At existing high disposal volumes, 400,000 cy per month could be disposed at the Alcatraz site during October through April, and 300,000 cy per month could be disposed during May through September. Therefore an average of approximately seven barge loads per day would dispose at the Alcatraz site during any one month from October through April, while an average of five barge loads per day would dispose at the site during any month from May through September. It is expected that daily disposal frequencies would be greater than this on occasion. If disposal frequency triples at times, as was assumed for SF-DODS above, then 21 disposal events per day would be expected at times from October through April, and 15 disposal events per day would be expected at times from May through September.[1] At these frequencies, initial disposal plumes may not always fully dissipate between disposal events, so that some cumulative degradation of Central Bay water quality could be expected. This is particularly true given that under PN 93-3 the COE has been successfully managing the site to minimize mounding by maximizing dispersion from the site. In addition, because of the dynamic nature of currents in the Central Bay, these plumes are not restricted to the immediate vicinity of the disposal site. Since fish may avoid the area for 2 to 3 hours following a disposal event, cumulative effects on fish use of Central Bay may also occur during periods of high-frequency disposal (see section 6.1.2). Finally, dredged material particles may resuspend several times after their initial dispersion from the disposal site, incrementally increasing suspended sediment loads and turbidity levels throughout the Central Bay.

At medium overall in-Bay disposal volumes (2.4 mcy per year, or 50 percent of all SUAD material) the average frequency of disposal at the Alcatraz site would be less, but existing monthly site capacities could still occasionally be reached. At such times, the same potential water quality effects noted above could occur. However, this degree of use would not occur as regularly or as often, so that the overall potential for adverse effects to Central Bay water quality would be reduced. Perhaps more importantly, a medium overall disposal volume would allow for the possibility of reducing the monthly disposal limits at the site, so that occasional periods of high-frequency disposal could be better avoided. For example, even if the entire 2.4 mcy of dredged material were disposed only at the Alcatraz site, this could be accomplished by disposing at a rate of 200,000 cy per month year-around. This equates to an average of just over three barge loads per day. In addition, a reduction in the overall volume of in-Bay disposal means a reduction in the incremental contribution to the Central Bay's overall suspended sediment loads and turbidity levels. Nevertheless, absent any changes in the existing monthly disposal limits, some potential would remain for occasional high-frequency disposal and cumulative adverse water quality effects at medium overall disposal volumes.

At low disposal volumes (0.96 mcy, or 20 percent of all SUAD material), high-frequency disposal events, and cumulative water quality effects, would be even easier to avoid. The incremental contribution to overall suspended sediment loads and turbidity levels would be negligible.

Carquinez Strait Disposal

Federal maintenance dredging of the Mare Island channel has historically generated the majority of the dredged material disposed at the Carquinez Strait disposal site. The U.S. Navy's Mare Island Naval Shipyard was the primary facility for which this dredging was performed. The recent closure of the Mare Island Naval Shipyard has significantly reduced the need for dredging at this location, since the remaining navigation interests in the area do not require -36-foot channel depths. Consequently, the channel was not maintenance dredged in 1995, and it is unclear when it will next be dredged or the volume of material that will need to be removed. Nevertheless, as a worst case, the following evaluation is based on disposal occurring at the full existing designated capacity of the Carquinez Strait disposal site.

The Carquinez Strait disposal site can receive as much as 1 mcy of dredged material in any one month (but a yearly maximum of 2 or 3 mcy depending on the year). This equates to an average of approximately 17 disposal events per day. If actual disposal frequency triples on occasion, then as many as about 50 disposal events per day could occur at times.[2] Such disposal frequencies, occurring in the relatively constricted waters where this disposal site is located, have the potential to cause some cumulative degradation of water quality, particularly in Carquinez Strait and Mare Island Strait. Given the importance of the Carquinez Strait as a migratory corridor for several sensitive fish species, including salmon and striped bass, the RWQCB's 1989 Basin Plan amendments provide for restricting disposal at this site in the spring and fall (see section 6.1.2 below).

At medium overall in-Bay disposal volumes (2.4 mcy per year, or 50 percent of all SUAD material) the average frequency of disposal at the Carquinez Strait site would be less, but existing monthly site capacities could theoretically still be reached on occasion. In this event, potential water quality effects as described above could still occur, but on a less frequent basis. Given the site's distance from many of the major dredging projects elsewhere in the Estuary, it would be highly unlikely for projects that have traditionally used other disposal sites to be redirected to the Carquinez Strait site. Therefore, a reduction of overall in-Bay disposal would allow for the possibility of reducing the monthly site limits at the Carquinez Strait site, so that occasional periods of high-frequency disposal could be better avoided. Nevertheless, some potential would remain for cumulative adverse water quality effects to occur. For these reasons, there is a small potential for direct or cumulative adverse water quality effects from disposal of medium volumes of "suitable" material at the Carquinez Strait site.

At low overall in-Bay disposal volumes (0.96 mcy, or 20 percent of all SUAD material) high-frequency disposal events at the Carquinez Strait site, and cumulative water quality effects, would generally be avoidable.

San Pablo Bay Disposal

The San Pablo Bay disposal site is authorized to accept a total of only 500,000 cy of dredged material per year. It is theoretically possible that this entire amount could be disposed at the site in a one-month period. In that case, water quality effects similar in degree to those described above for the Alcatraz site are possible during that one month (an average of about eight barge loads would be disposed at the site per day, versus seven for the Alcatraz site). However, the largest user of the site is typically the COE, for federal maintenance dredging of the Petaluma River "across the flats" channel, and this project is typically dredged only every 5 to 10 years. Since 1941 the project has been dredged seven times, with volumes ranging from 266,000 cy to 788,000 cy.[3] Other projects may also be authorized to use the San Pablo Bay disposal site during the same general timeframe as the COE; however, these projects are dredged infrequently, and/or the volumes associated with them tend to be low (see Chapter 4 and Appendix E). It is therefore considered to be very unlikely for high frequency disposal to occur at this site except on very rare occasions.

As is true for the other in-Bay disposal sites, the San Pablo Bay site is dispersive, and dredged material particles will therefore resuspend after their initial dispersion from the disposal site. However, huge volumes of sediment (100 to 250 mcy) naturally resuspend into the water column from San Pablo Bay's extensive shallows and mudflats. Since the total annual disposal capacity is only 500,000 cy, there is a negligible potential for direct or cumulative adverse water quality effects from disposal of SUAD material at the San Pablo Bay site.

Suisun Bay Channel Disposal

Unlike the other in-Bay disposal sites, the Suisun Bay Channel site is not a multi-user site. This site may only be used by the COE, for federal maintenance dredging of the Suisun Bay Channel. The use of the site is not expected to change under any LTMS alternative. The dredged material placed at this site is comprised of fine sand, disposal of which has less potential to degrade water quality than the silts and clays often disposed at the other in-Bay sites. In addition, the annual capacity of this site is small (200,000 cy), such that any direct water quality impacts would be temporary and localized, and cumulative effects would not be expected. Finally, since only one project is associated with this site, project-specific conditions can be developed to ensure that, overall, no significant water quality impacts would occur. For these reasons, there is a negligible potential for direct or cumulative adverse water quality effects from disposal of SUAD material at the Suisun Bay Channel site.

However, it should be noted that sand such as that dredged from the Suisun Bay Channel represents a valuable resource with existing markets. Commercial sand miners are active in the vicinity, and excavate the same kind of material from nearby natural shoal areas. Any cumulative water quality effects of these mining activities could be reduced if maintenance dredging of the Suisun Bay Channel could be coordinated with sand mining in such a manner that the total amount of sand mining from the nearby shoals is reduced.

Overall In-Bay Risk/Impact and Benefit Ratings — Water Quality

Since no direct water quality benefits arise from in-Bay disposal of dredged material, a "negligible benefit" rating (0) appears in Table 6.1-1 for all disposal volumes.

At high overall in-Bay disposal volumes there is a potential for some cumulative degradation of San Francisco Bay water quality to occur, due both to initial disposal plumes and to subsequent resuspension, especially during periods of high-frequency use of the Alcatraz and Carquinez sites. Because of this, in-Bay disposal of high volumes of dredged material has been assigned a "moderate risk/impact" rating (-2) in Table 6.1-1.

At medium overall in-Bay disposal volumes, the ability to manage disposal sites to avoid high-frequency disposal is increased. Nevertheless, some potential for high-frequency disposal and for cumulative water quality effects would remain, especially associated with the Alcatraz and Carquinez Strait sites. In-Bay disposal of medium volumes of dredged material has therefore been assigned a "low risk/impact" rating (-1) in Table 6.1-1.

At low overall in-Bay disposal volumes, the ability to manage disposal sites to avoid high-frequency disposal is greatest. In addition, the overall disposal volume would be such that neither direct nor cumulative adverse water quality effects would be expected. Therefore, in-Bay disposal of low volumes of dredged material has been assigned a "negligible impact" rating (0) in Table 6.1-1.

6.1.1.3 Disposal at Upland/Wetland Reuse Sites

Placement of SUAD-class dredged material at upland, wetland, or reuse sites can have either beneficial or adverse effects on water quality, depending on the type of reuse and the specific circumstances at the placement site. The following paragraphs generally describe the kinds of water quality benefits and impacts that may be associated with different types of dredged material disposal or reuse. However, to determine whether and how potential benefits will actually be realized, and whether and how potential adverse effects can be avoided or minimized, a case-specific evaluation would need to be conducted prior to individual project implementation. Note that this discussion does not address temporary, construction-related water quality impacts that may be associated with any type of reuse. These would have to be addressed on a case-specific basis. This discussion also does not address water quality effects that would occur regardless of whether dredged material is used for a project. For example, to the extent that levees will be maintained with some source of fill material, impacts of maintaining levees *per se* are not evaluated. Similarly, if dredged material is proposed as fill in a construction project, only the unique effects of using dredged material would be addressed — not the overall impacts of building the construction project itself (such as changing surface water hydrology by placing fill for a new roadway). It is assumed that such non-dredged material impacts would be addressed separately by the project proposing to use dredged material as a fill source.

In terms of affecting water quality at upland, wetland, or reuse sites there are three kinds of dredged material projects: habitat (wetland) restoration; levee maintenance; and rehandling sites. Other specific types of dredged material reuse affect water quality in a manner similar to one of these three. The three types of projects differ from each other in terms of water quality effects as described below.

Habitat Restoration

When properly sited and designed, habitat restoration projects (particularly wetland restoration) can result in a net benefit to water quality by increasing sediment retention, filtration of pollutants, and shoreline stabilization. Such benefits are likely to be realized to some degree by any wetlands restoration project that is properly designed so that it results in a functioning wetland. But the potential benefits could be diminished if, for example, a tidal wetland project is over-filled so that appropriate elevations for wetland vegetation are not created. Adverse water quality effects of wetland restoration can also occur if projects are improperly sited or designed (see Chapter 4). These may include, for example, degradation of surface water quality associated with site runoff, degradation of groundwater quality due to leachate from the site, or increased tidal prism resulting in incrementally increased salinity in the adjacent water body. Project-specific siting and design considerations are particularly important to ensure that adverse water quality impacts are avoided. For example, leachate impacts can be avoided by ensuring that the site is not on top of an aquifer used for drinking water (see Companion Policies in Chapter 5).

A high overall volume of placement at upland/wetland reuse (UWR) sites (80 percent of all SUAD material, or 3.8 mcy per year) has the potential to achieve the greatest water quality benefit, because the greatest number and largest acreage of wetland sites would be restored. As detailed in Appendix N and section 4.4.3, it is assumed that 66 percent of this volume (~2.5 mcy per year) would be reused in wetland restoration projects. This equates to an assumed 17 or 18 new wetland restoration projects, as follows: a total of 16 mcy would be reused in two habitat restoration projects during the first 5 years; an additional 28 mcy would be reused in four other projects during the subsequent 10 years; and 82 mcy would be reused in 11 or 12 habitat projects, or one every 3 years, over the remaining 35 years. It is assumed that all the projects with moderate or high feasibility rankings (LTMS 1994f) would be restored. These projects would result in the restoration or creation of as many as 12,500 acres of wetlands for the region. The potential water quality benefits from this degree of wetlands restoration are considered to be moderate (+2), given that over 90 percent of the Estuary's historic wetlands have been destroyed. (However, other environmental effects would also occur: see, for example, Fish and Wildlife Habitat Comparisons [section 6.1.2] and Air Quality Comparisons [section 6.1.5].) At the same time, minor adverse effects (-1) to surface water and/or groundwater could occur since, at high placement volumes, it is assumed that at least some projects would be constructed in relatively sensitive areas.

At medium overall placement volumes (50 percent of all SUAD material, or ~2.4 mcy per year), 63 percent of this material (~1.5 mcy per year) would be used for wetlands restoration (see Appendix N and section 4.4.3). This equates to an assumed 10 new wetland restoration projects (two small projects in the first 5 years, two larger ones in the subsequent 10 years, and six over the remaining 35 years). These beneficial reuse projects would result in 7,225 additional acres of wetlands for the region. The potential water quality benefits from this degree of wetlands restoration are considered moderate (+2), given that over 90 percent of the Estuary's historic wetlands have been destroyed. At the same time, fewer projects would be constructed overall, so that relatively sensitive areas could more easily be avoided. Therefore, adverse effects to surface water and/or groundwater are expected to be negligible (0).

At low overall placement volumes (20 percent of all SUAD material, or ~1 mcy per year), 57 percent of this material (only ~0.55 mcy per year) would be used in wetland restoration projects (see Appendix N and section 4.4.3). In this case, it is assumed that only four new wetlands would be created (one small project in the first 5 years, one large project in the subsequent 10 years, and two large projects in the remaining 35 years). These projects would result in 2,812 additional acres of wetlands for the region. The potential water quality benefits from this degree of wetlands restoration is considered to be low (+1). At the same time, relatively sensitive areas should easily be avoidable. Therefore, adverse effects to surface water and/or groundwater are expected to be negligible (0).

Levee Maintenance and Stabilization

If high volumes of dredged material (80 percent of all SUAD material, or 3.8 mcy per year) are placed in UWR sites, it is assumed that 14 percent of this volume (~0.5 mcy per year) would be used for levee maintenance (see Appendix N and section 4.4.3). No direct water quality benefits (0) are associated with using dredged material (or any other source of fill) for levee maintenance, at any placement volume. Reuse of dredged material for levee maintenance can adversely affect water quality primarily by increasing the levels of dissolved constituents in surface runoff and groundwater. The potential for levee maintenance to have adverse effects on water quality depends in part on where the project occurs. There is the greatest potential for the reuse of dredged material for levee maintenance in the Delta; however, the Delta is also the most sensitive area in terms of water quality because drinking water standards generally apply throughout the area, and because of the presence of sensitive, special status species (see Chapter 4). Saline dredged material from the more marine portions of San Francisco Bay would not generally be used for levee maintenance in the Delta, and even material having compatible salinities would not be place on the outboard (river-facing) sides of levees (see Companion Policies, Chapter 5). In addition, placement of dredged material on delta levees would be subject to site-specific attenuation factors developed to ensure that beneficial uses are not degraded. Therefore, direct adverse water quality impacts to Delta rivers and sloughs are not expected. However, there still may be some cumulative adverse effects to water quality on the Delta islands associated with surface runoff and groundwater.

A limited volume of dredged material would be used and a limited number of levee miles would be maintained using dredged material (relative to all ongoing levee maintenance work). Therefore, assuming application of all relevant companion policies, there is a low potential for adverse water quality effects (-1) from reusing dredged material for levee maintenance.

At medium overall placement volumes (50 percent of all SUAD material, or ~2.4 mcy per year), the percentage assumed to be reused for levee maintenance increases to 22 percent; however, the same total volume (~0.5 mcy per year) would be reused under both medium and high scenarios (see Appendix N and section 4.4.3). Therefore, the potential for water quality benefits are negligible (0), and the potential for adverse water quality impacts at medium overall placement volume is low (-1), identical to that described above for high overall placement volumes.

At low overall placement volumes (20 percent of all SUAD dredged material, or ~1 mcy per year), 43 percent of this volume (~0.4 mcy per year) would be used for levee maintenance (see Appendix N and section 4.4.3). This is slightly less dredged material than would be reused under the high and medium overall placement volume scenarios, because other assumed UWR projects would leave somewhat less material available for levee reuse. Therefore, the potential for water quality benefits is negligible (0), and the potential for adverse water quality effects at low overall placement volumes is low, slightly less than described above for medium or high overall placement volumes.

Rehandling Facilities

No direct water quality benefits (0) are associated with dredged material rehandling facilities regardless of dredge material volume. Operation of rehandling facilities can affect either surface water quality or groundwater quality via runoff or leachate, as discussed under Habitat Restoration, above. If high volumes of dredged material (80 percent of all SUAD material, or 3.8 mcy per year) are placed in UWR sites, it is assumed that 20 percent (~0.75 mcy per year) would be processed at rehandling facilities (see Appendix N and section 4.4.3). One new moderate-size rehandling facility or two new smaller rehandling facilities would need to be constructed to process an average of ~0.75 mcy per year of SUAD material under a high overall placement volume scenario. (This is in addition to any facility[ies] constructed to rehandle the ~1 mcy per year of NUAD material assumed to be generated under all LTMS scenarios.) It is assumed that water management associated with operation of the additional rehandling facility(ies) will result in periodic discharges of return water on an ongoing basis. However, since only one or two additional facilities would be needed, most adverse water quality effects should be avoidable through application of appropriate siting and design measures. Nevertheless, there is a low risk or potential for some degradation of water quality (-1).

At medium overall placement volumes (50 percent of all SUAD material, or ~2.4 mcy per year), it is assumed that 16 percent of this volume (~0.4 mcy per year) would be processed at rehandling facilities (see Appendix N and section 4.4.3). At this volume, it is assumed that one additional rehandling facility would be required. In this case, most adverse water quality effects should be avoidable through application of appropriate siting and design measures, and adverse water quality effects should be negligible (0).

At low overall placement volumes (20 percent of all SUAD material, or ~1 mcy per year), no SUAD-class dredged material would be processed through rehandling facilities. Therefore, no additional rehandling facilities would be needed, and no adverse water quality effects would occur (0).

Overall Upland/Wetland Reuse Risk/Impact and Benefit Ratings — Water Quality

The greatest direct water quality benefits can be realized from the largest number of wetland restoration projects, and the largest number of wetlands would be created or restored at high overall placement volumes. Therefore, a "moderate benefit" rating (+2) has been assigned to the Habitat Restoration category of Table 6.1-1. At the same time, however, a minor degree of adverse water quality impacts is considered to be unavoidable for each of the different reuse types at high overall placement volumes. Therefore a "low risk/impact" rating (-1) has been assigned under the Habitat Restoration, Levee Maintenance, and Rehandling Facility categories in Table 6.1-1.

At medium overall placement volumes, some water quality benefits would occur as a result of wetlands restoration; a "moderate benefit" rating (+2) has therefore been assigned under the Habitat Restoration category in Table 6.1-1. There are also expected to be some minor unavoidable water quality effects associated with levee maintenance, since the same volume of dredged material would be reused on levees under both the high and medium overall placement volume scenarios. Therefore a "low risk/impact" rating (-1) has been assigned under the Levee Maintenance and Stabilization category in Table 6.1-1.

At low overall placement volumes, few wetlands sites would be restored, and water quality benefits would be minor. Table 6.1-1 reflects this with a "low benefit" rating (+1) for Habitat Restoration. Minor adverse water quality effects could still be associated with reuse of dredged material for levee maintenance, since only slightly lower volumes would be used relative to the medium and high overall placement scenarios. Therefore a "low risk/impact" rating (-1) has been assigned under the Levee Maintenance category in Table 6.1-1.

6.1.2 Fish and Wildlife Habitat Comparisons

Dredged material placement can have either beneficial or adverse effects on habitat quality for fish and wildlife. Chapter 4 discusses the fish and wildlife species and habitat types that may potentially be affected by placement of dredged material at ocean, in-Bay, and upland/wetland reuse sites.

Simple disposal of dredged material as a waste generally does not result in habitat benefits, and may have adverse effects depending on the site and the method of disposal. This can be true not only for unconfined disposal at ocean or in-Bay sites, but also when dedicated Confined Disposal Facilities (CDFs) or rehandling facilities are developed in existing upland or wetland locations for dredged material management. On the other hand, reuse of dredged material for habitat restoration, creation, or enhancement can have substantial environmental benefits that are significant to the region as a whole. Both open water aquatic habitat and upland or wetland habitats can be restored, enhanced, or created by reusing dredged material as a compatible, efficient source of fill or substrate. The following paragraphs compare the general potential for beneficial and adverse effects on fish and wildlife habitat quality that result from disposal and reuse of SUAD-class dredged material in the different placement environments. Note that, while dredged material can be reused for enhancement of open water aquatic habitat (for example, by restoring or creating appropriate depths for transplanting eelgrass or other submerged aquatic vegetation), the existing ocean and in-Bay sites discussed below are unconfined aquatic disposal sites as opposed to beneficial reuse sites. No new in-Bay or ocean sites are currently being proposed by LTMS; any new open water sites proposed for habitat restoration or enhancement would have to be evaluated separately. The following evaluation therefore focuses on the existing unconfined aquatic disposal sites, and does not address the potential effects of aquatic beneficial use sites on fish and wildlife habitat quality.

The fish and wildlife habitat impacts and benefits of high, medium, and low volumes of dredged material placement in each disposal are summarized in Table 6.1-2, and discussed in detail in the following sections.

6.1.2.1 Ocean Disposal

SF-DODS

Disposal of dredged material at SF-DODS would not result in any direct fish or wildlife habitat benefits; therefore Table 6.1-2 includes "negligible benefit" ratings (0) in the high, medium, and low volume categories for ocean disposal. At high ocean disposal volumes some on-site benthic organisms would be directly smothered, while at medium and low disposal volumes, most on-site benthic organisms should be able to burrow through the thin dredged material deposit. However, at any disposal volume, physical alterations to benthic habitat at the disposal site will occur as a result of deposition of dredged sediments whose grain size and other physical characteristics differ from the natural sediments at the site. These physical changes could ultimately alter the mix of benthic infaunal species at the site. However, these changes would not affect any unique or limiting habitats, would only occur within the boundaries of the disposal site, and would affect only a very small proportion of the extensive, similar habitat throughout the region (see Chapter 4). Therefore, benthic habitat effects are considered to be negligible.

Potential adverse effects could occur to the fish and wildlife habitat in the water column, in relation to the temporary on-site water quality effects discussed above and as a result of disturbance due to disposal operations. However, water quality-related habitat effects would be temporary, and would be contained entirely on site. As discussed in section 6.1.1.1, high-frequency disposal activity that could potentially result in cumulative on-site water quality- or disturbance-related habitat degradation is not expected to occur. In addition, SF-DODS is not located in critical or limiting habitat for any species, so that any fish and wildlife that may occasionally avoid the site would not be expected to suffer adverse impacts from moving to another area. Nevertheless, there is some risk of occasional habitat quality degradation. Therefore, the same ratings assigned to ocean disposal under water quality (section 6.1.1.1) are also assigned in Table 6.1-2 to adverse

Table 6.1-2. Potential Impacts and Benefits to Fish and Wildlife Habitat, by Placement Environment and Disposal Volumes

	FISH AND WILDLIFE HABITAT BENEFITS (a)			FISH AND WILDLIFE HABITAT IMPACTS/RISKS (b)		
Placement Environment	*High Volume*	*Medium Volume*	*Low Volume*	*High Volume*	*Medium Volume*	*Low Volume*
Ocean	0	0	0	-1	0	0
In-Bay	0	0	0	-2	-1	0
Upland/Wetland Reuse						
Habitat Restoration	+3	+2	+1	-3	-1	0
Levee Maintenance	0	0	0	0	0	0
Rehandling Facility	0	0	0	-1	0	0

Notes: a. Benefits: +3 = High Benefit; +2 = Moderate Benefit; +1 = Low Benefit; 0 = Negligible Benefit
b. Impacts/Risks: -3 = High Risk/Impact; -2 = Moderate Risk/Impact; -1 = Low Risk/Impact; 0 = Negligible Risk/Impact